Summary Translation of Question & Answer Session at
FY2017 R&D Strategy Briefing

Date and time: September 20, 2017 (Wed) 13:30-14:45
Venue: Okada Hall, Fujitsu Laboratories Ltd.
Presenter: Shigeru Sasaki, CEO, Fujitsu Laboratories Ltd.

Questioner A

Q1: *How much effort are you putting into "Borderless IoT Security™", and specifically what sort of research are you doing?*

A1: Fujitsu Laboratories has about 60 security experts. We are undertaking research and development in areas including cyberattacks, making personal information protection and concealment, authentication using biometrics, and creating knowledge bases with regard to failures by cyberattacks in networks and computer systems. We are conducting research in these areas by using AI to automate detection process as much as possible by machine learning how to identify new types of viruses, which are multiplying every day, through learning of past attack methods. Fujitsu provides the infrastructure for many computer systems around the world. When connecting from IoT devices to back-end IT infrastructure, the data crosses companies, industries, and countries without regard for borders, so Fujitsu Laboratories is calling our system to secure the reliability and confidentiality of data, "Borderless IoT Security™". We are working to put together a comprehensive security concept. We hold numerous basic technologies in this field, but due in part to the confidential nature of some patents, this is an area of research and development that is hard to publish, but we show these activities when we find opportunities for further announcements. For example, our latest new security technology is introduced in "High-Speed Forensic Technology for Promptly Analyzing Damage After Targeted Attacks," an article on page 69 of the September issue of *FUJITSU*, our technology information magazine, as part of a special report on the cutting-edge research and development. We think that working on comprehensive security remains one of Fujitsu Laboratories' trademarks.

Q2: *Please tell us the differences between your 'Explainable AI technology' and previous AI.*

A2: Technology to convert theses and data to graph data is an area Fujitsu Laboratories has been researching for over 20 years. We were able to demonstrate an Explainable AI by fusing our Deep Tensor technology with Knowledge Graph, which are databases where graph-structured data has been converted to knowledge. By applying deep learning to multidimensional graph data at high speed, it has become possible to know the partial characteristics of the graph data, expressed as tensors, with those results. By feeding those characteristics back into the system and referencing the Knowledge Graph, it has become possible for us to know the reasoning and basis behind AI analysis results. As far as I know, no other company has the technology to build growing Knowledge Graphs. Previous deep learning efforts involved reading 2D images, and building a learning model that sets product-sum operations. When an image a user wants to evaluate is input into a deep learning model, it can only output correct or incorrect answers. With this newly developed technology, a major feature is its ability to also explain the logical basis for this determination. In the upcoming presentation from Seishi Okamoto, Deputy Head of Artificial Intelligence Laboratory, titled "Fujitsu Fuses Deep Tensor with Knowledge Graph to Explain Reason and Basis Behind AI-Generated Findings," we will introduce practical approach about an example involving genomic analysis.

Questioner B

Q1: *Could you please tell us about how you have moved budget and human resources from areas such as devices to new fields?*

A1: Today we will be introducing 8 major topics of research, one of which is "Materials Informatics", which has become a technological trend in the fusion of the physical and the chemical. At Fujitsu Laboratories, we have both chemical knowledge, focused on the combination of elements in materials synthesis, and physical knowledge, about the physical properties of materials and device characteristics, accumulated through research into topics such as semiconductors. Currently we are preparing to search for new materials using AI. Research area of the HEMT, a field focused on compound semiconductors, has led to our current power devices, leveraging our experience to date. We are shifting resources in the form of this valuable experience and know-how to the research areas of "Compound Semiconductors" and "Materials Informatics".

Q2: *Could you please tell us how you will deploy the strengths of your AI technology outside Japan?*

A2: In Canada, Google is investing in Vector Institute, while at the same time it has set up Google Brain Toronto and is bringing together deep learning researchers. Recently, the fact that AI demonstrates excellence in games has been reported. The practical application of AI in society, however, has been a significant issue. Fujitsu Laboratories is working with University of Toronto, which is strong in software that applies to societal systems on research to work out unsolved problems in the medical field, to begin with. Going forward, an approach combining AI with quantum computing technology will be necessary. Fujitsu aims to start a global computing transformation while building strong relationships with many organizations outside Japan by commercializing our "Digital Annealer", in particular, which is currently attracting attention for use across many layers, from devices to middleware to services.

Questioner C

Q1: *Previously you have spoken of supercomputer technology as a key word, but it seems you are now talking more broadly about AI and quantum computing, so could you please talk about the connections between them and Fujitsu Laboratories' thinking about this?*

A1: The IT company, including Fujitsu, has adopted computational methods using many CPUs in parallel, born out of high-performance computing, as an approach to quickly solve current problems and issues. There are many problems, however, that still cannot be solved, even with this approach. Now, the possibility has arisen that these problems can be solved by the advance of AI and quantum computing. As computer processing gets faster, it will become possible to handle an exponentially growing number of combinations. With current computers, however, there is a limit to the performance improvements that can be achieved with CMOS miniaturization. We have also come to understand that there are problems that cannot be solved even with parallel high-performance computing. Fujitsu Laboratories is approaching these problems that could not be solved previously by using "Domain-Specific Computing". By combining accelerators specialized for AI and accelerators that can rapidly solve optimization problems with current high-performance computing, it has become possible to dramatically improve computer performance. By connecting existing server systems, high-performance computers, AI and quantum computing, it will become possible to utilize computing power to solve problems that had previously been unsolvable. Going forward, we will clarify which problems have not been solved around the world,

and then provide solutions as service businesses. In order to go beyond current limits to transistors, new architectures are becoming necessary, and we are also working on research and development in that area.